LARP beam instrumentation possible future activities

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Beam instrumentation and LARP

- BI has been an important field in LARP from the beginning
- Several LHC instruments have been provided by LARP, either entirely or in partnership with CERN
- R&D in the area of Beam Instrumentation through LARP has provided important input for the design and construction of several LHC diagnostic systems

Some past LARP-BI activities

- Luminosity monitors: delivered the full system (LBNL)
- Schottky monitors: delivered the design of the pick-ups and most of the electronics (FNAL)
- Abort gap monitor: delivered a feasibility study (LBNL)
- Tune and chromaticity (PLL): provided help and facilities for the testing of the system (BNL)
- Synchrotron light: contributed in the design trough a LTV (A.Fisher)

The collaborations that worked well had:

- Clear objectives and firm deadlines
- Support from the laboratory management allowing the allocation of appropriate resources
- Committed project leaders on both sides of the Atlantic
- R&D into areas that were of direct benefit to the laboratory concerned

Future activities

- LHC is now more or less completed
- Some instrument or functionality has been delayed for lack of resources
- Large plan to rebuild/consolidate the injectors
- LHC luminosity upgrades either under study or already under construction

Possible future projects (1)

- LHC
  - In-cryostat beam loss monitors for the inner triplets (luminosity upgrade)
  - Longitudinal density monitor (delayed project)
- PS2
  - Ion profile monitors

Possible future projects (2)

- LINAC 4 (SPL)
  - Laser based emittance measurement
- SPL
  - In-cryostat laser profile monitors

LHC inner triplets BLM

- In order to protect the magnets detectors that can be installed inside the cryostat are required
- The dose is relatively high (20kGy/year)
- Should work reliably for the lifetime of the magnets (10 years)
- Some studies already done at CERN, but more is needed.
- Tasks: simulations (FLUKA like), beam test, design, integration

LHC LDM

- Needed to measure the longitudinal parameters of the beams, in particular ghost bunches, unbunched beam and tails
- Marie Curie fellow at CERN already working on the detection side
- Need to study the coupling and transport of synchrotron light outside the tunnel with high temporal resolution (<50ps)
- Tasks: simulations (optics), design, test

PS2 Ion profile monitors

- Need a monitor for the continuous observation of the transverse beam properties
- High beam current 4 10^{11} p @ 25 ns
- Impedance and e-cloud problems
- Space charge compensation
- Need fast readout (non optics): noise, beam pick-up
- Activities: RF simulations, tracking of e^-, design, (beam) tests

LINAC 4 laser e-meter (1)

- Need to measure the Twiss parameters at the end of the LINAC in order to match injection in the BOOSTER
- At high energy (160 MeV) slit&grid systems are not suitable
- Multi profile methods are difficult because of the space charge
- Will replace the slit by a focused LASER which creates a beamlet of H^0 atoms

LINAC 4 laser e-meter (2)

- Laser system trough collaboration with RHUL (UK)
- Need to measure the transverse profile of the neutral beamlet after separating it from the main beam
- A sensitive detector would allow using a low power LASER (with fibre transport)
- Activities: R&D on detectors (solid state?), simulations (beam dynamics and FLUKA), beam tests

SPL laser wire scanners

- Standard wire scanners are incompatible with super conducting cavities
- SPL will probably have long cryostats with the “inter-tank” space inside the cryostat
- Need to adapt the laser wire scanner technique to the cryogenic environment
- Activities: Cryo/optics design, electrons separation/ detections design, prototyping, tests.

Long term visitors (1)

- Already very positive experience with LARP long term visitors
- Would like to profit as much as possible from this program
- A lot of analysis work during the commissioning phase of LHC

Long term visitors (2)

- Possible activity fields are
  - Transverse synchrotron light monitors and abort gap monitors
  - Schottky monitors
  - Luminosity monitors
  - Beam loss monitors

Long term visitors (3)

- Many tasks can be carried out by students or fellows, their work require however a close supervision and it is more in this region that we need help
- A lot of experienced people in the various US laboratories whose knowledge would be very helpful during this delicate phase

Conclusions

- The LARP program provided considerable help in the design and construction of several LHC instruments
- R&D in this field is well adapted for a collaborative effort
- Many different fields of study so that several laboratories can find their corner
- Projects can be relatively small and well defined reducing the project risk